

## DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

December 18, 1978

NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER

IN REPLY
REFER TO: ANA-220

ATLANTIC CITY, NEW JERSEY 08405

.

SUBJECT: Los Angeles Simulation Model Calibration Results and Input Data Summary for Stage 1 Experiments

FROM: NAFEC Program Manager, ANA-220

TO: Ray Fowler, AEM-100

Enclosed are data packages for use during the third Task Force meeting on January 22, 1979.

Attachment A presents the results of the Simulation Model Calibration.

Attachment B contains the model input data for Configurations A, B, and C.

Attachment C contains the model input summary for the Los Angeles Stage 1 Experiments.

Attachment D contains preliminary data for the Los Angeles Stage 2 Experiments.

These attachments should be reviewed, revised, and approved by the Los Angeles Task Force prior to use in the model runs

JOHN R. VANDERVEER

Enclosure

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#### ATTACHMENT A

# SIMULATION MODEL CALIBRATION OUTPUT DATA

- A. FLOW RATES
- B. DELAYS
- C. TRAVEL TIMES

SEE HOURLY SUMMARY (TABLE 1) AND

QUARTER HOUR FIGURES 1 TO 5

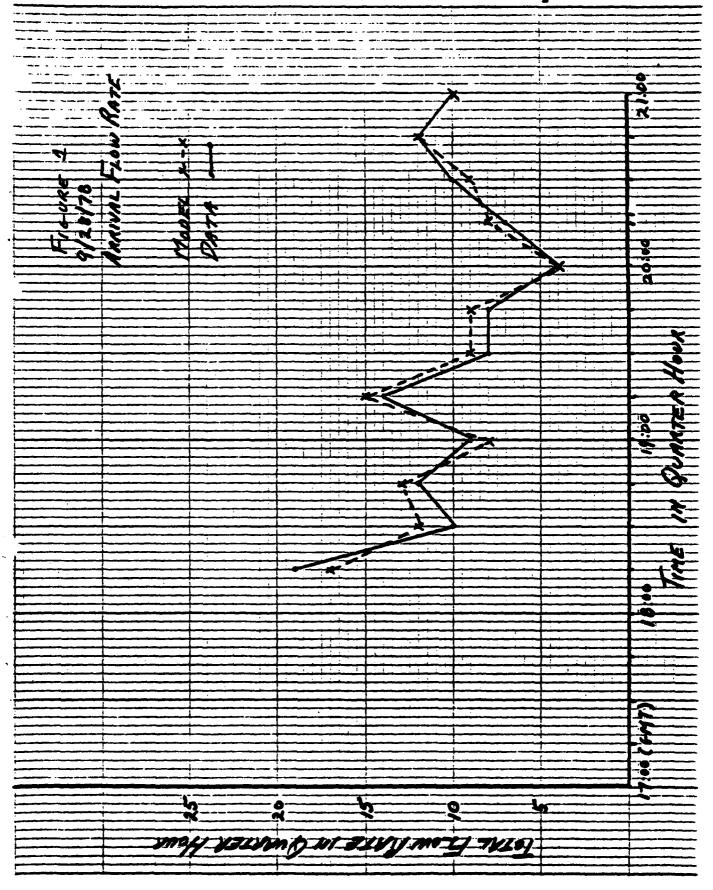
Los Angeles International Airport

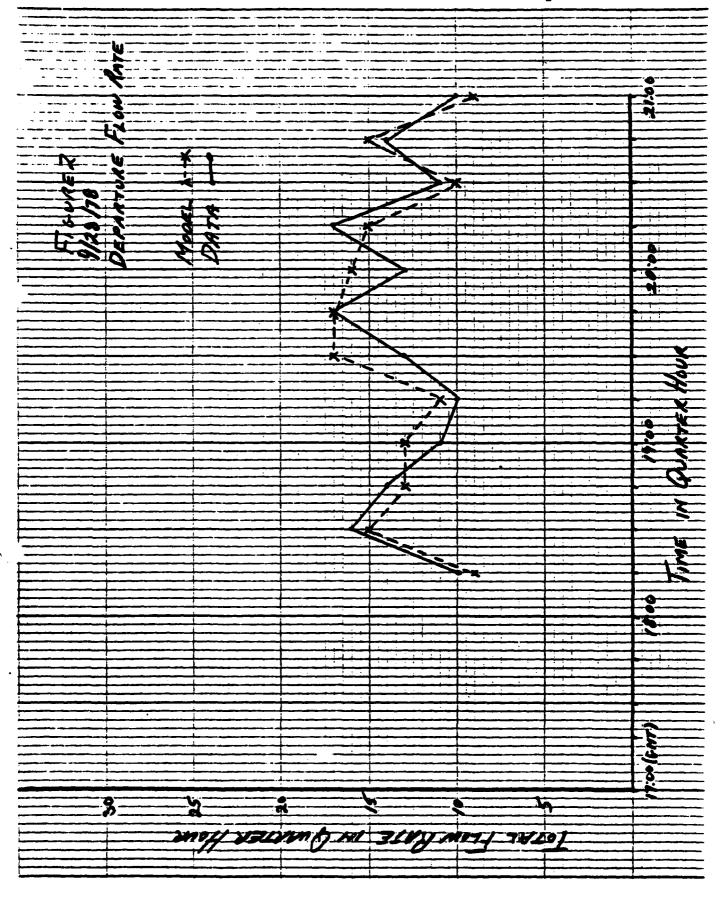
Los Angeles Airport Improvement Task Force Delay Studies

January 1979

Table 1
Hourly Comparison of Output Data for Simulation Model Calibration

Time	Arrival Flow Rate Data Model (S.D.)	Departure Flow Rate Data Model (S.D.)
1800-1900	50 50 (0.48)	51 50 (1.69)
1900-2000	34 (0.48)	53 58 (1.14)
2000-2100	39 (0.52)	52   49 (1.41)
Time	Average Arrival Air Delay (minutes) Data Model (S.D.)	Average Fix to Threshold Travel Time (minutes) Data Model (S.D.)
1800-1900	0.92 1.69 (0.34)	9,33 7.84 (0.36)
1900-2000	1.31 1.04 (0.18)	9.69 9.39 (0.19)
2000-2100	1.12 0.60 (0.05)	9.75 8.72 (0.14)
Time	Average Arrival Threshold to Gate Travel Time (minute Data Model (S. D.)	es)Travel Times (minutes)
1800-1900	3.56 3.46 (0.11)	8.82 10.67 (1.21)
1900-2000	3.96 3.64 (0.15)	10.93 10.61 (1.67)
2000-2100	2.87 3.56 (0.25)	8.63 7.32 (0.40)





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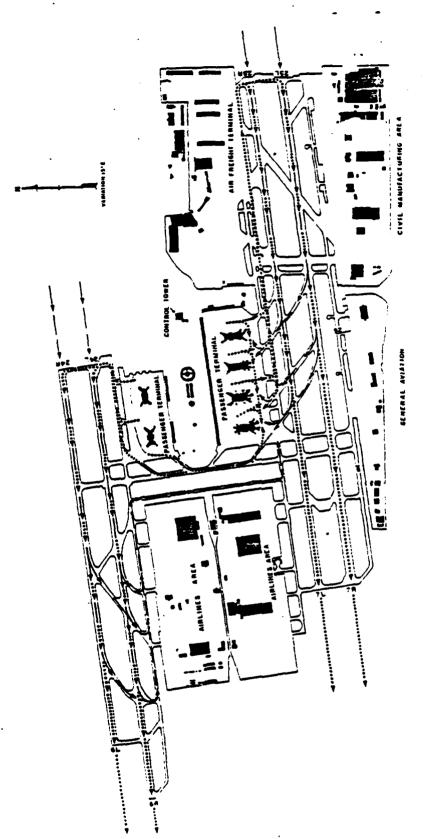
### ATTACHMENT B

Configurations A, B, and C Model Input Data

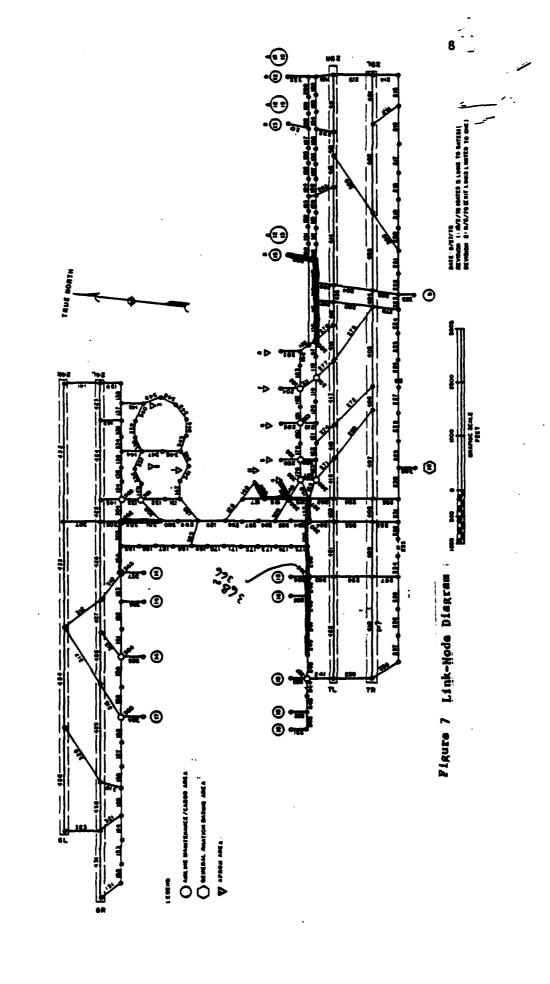
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January 1979



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ALUES IN 4 SETS OF 32. ARRIVAL / ARMIVAL. DEPARTURE / S COMPOSED OF 16 PAIRS OF MEAN AND STANDARD GEVIATION BOSSIME MAYS OF A 17 FIRST WILLIAMS AND STANDARD OF VIATE V	CLASSES 1 D CLASS CLASSES 1 D CLASS CLASSES 2 D CLASS	A ( 4 (Y-X) 70 S	(1,3), (1,6), (2,1), (2,2), (2,3), (1,1), (4,2), (4,3), (4,1), (4,2), (4,3), (4	O LEAD A/C FIR O TRAIL A/C RUNDAY O TR	ALUES IN 4 SETS OF 32. A/A (N.MILES). D/A (N.MILES).	2.97 .65 J.69 .66 J.61 .5 2.97 .65 2.89 .66 2.81 .5	2.97 .65 2.19 .66 2.61		1.23 .24 1.13 .23 1.13	2.40 .00 2.40 .00 2.40 .00		6 .76 .19 .97 .23 .74 .0 6 .76 .19 .97 .23 .74 .0	16 176 .19 .07 .23 .74 .8		VALUES IN 4 SETS OF 32: A/A (M.MILES): D/A (M.MILES)	2150 .65 4.12 .60 4.00	70 2.23 .65 2.17 .60 2.11		25. 55. 55. 55. 55. 55.	64. 65. 64. 45. 64.	06 2:40 .00 2:40 .00 2:40	70.	16. 10. 16. 10. SITE 60		ac. 11. 70. 11. Co.	
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EPARATIONS EPARATION VALUES IN & SETS OF 32, ARRIVAL / ARMIVAL, DEPARTURE / SET OF 32 18 COMPOSED OF 16 PAIRS OF MEAN AND STAMMARD GEVIATION A KETS ARE BOSSIES F MAYS OF ALL PAIRS OF MEAN AND STAMMARD GEVIATION	A/C CLASSES 1 10 CLASS A/C CLASSES 1 2 CLASS 2 1 C CLASS	4	1.2), (1.3), (1.4), (2.1), (2.2), (2.3), (3.2), (4.3), (4.	A/C RUNWAY 0 LEAD A/C FIR 0 TRAIL A/C RUNWAY 0 TF	NITON VALUES IN 4 SETS OF 32, A/A (N.MILES), D/A (N.MILES), .78 9.67 65 5.49 .40 5.41 .55		26 2.97 .65 2.89 .60 2.61		.29 1.23 .24 1.13 .23 1.13				16 176 .19 .07 .23 .74 .8		REPARATION VALUES IN 4 SETS OF 32, A/A (M.MILES), D/A (M.MILES)	. 70 3150 .65 4.12 .60 4.00	70 2:23 .65 2:17 .60 2:11	· 11.2 da. /1.2 ca. f2.2 d2.	75. 45. 55. 85. 45.	05. C2. C4. 42. 64. 62.	. 66 2:40 .00 2:40 .00 2:40 .00 2:40 .00 .00 .00 .00 .00 .00 .00 .00 .00 .		16. 16. 16. 16. 16. 16. 16. 16. 16. 16.		36. 11. 57. 11. 54.	
ALUES IN 4 SETS OF 32. ARRIVAL / ARMIVAL. DEPARTURE / S COMPOSED OF 16 PAIRS OF MEAN AND STANDARD GEVIATION BOSSIME MAYS OF A 17 FIRST WILLIAMS AND STANDARD OF VIATE V	MERE ARE & A/C CLASSES 1 D CLASS 2 C CLASS 2 C CLASS 3 C CLASS	A L P A D P A D D P A D D P A D D P A D D P A D D P A D D P A D D P A D D D P A D D D P A D D D D D D D D D D D D D D D D D D D	1.2), (1.3), (1.4), (2.1), (2.2), (2.3), (3.2), (4.3), (4.	NAMENAY O LEAD A/C FIR O TRAIL A/C RUNDAY O TR	3.66 .78 9.67 .65 5.49 .60 5.41 .55		26 2.97 .65 2.89 .60 2.61		.29 1.23 .24 1.13 .23 1.13		0. 30. 30. 30. 30. 31.1 30. 15		00 016 176 019 097 023 076 08	The state of the s	MATION VALUES IN 4 SETS OF 32, A/A (M.MILES), D/A (M.MILES)	. 70 3150 .65 4.12 .60 4.00	70 2:23 .65 2:17 .60 2:11	· 11.2 da. /1.2 ca. f2.2 d2.	75. 45. 55. 85. 45.	05. C2. C4. 42. 64. 62.	. 66 2:40 .00 2:40 .00 2:40 .00 2:40 .00 .00 .00 .00 .00 .00 .00 .00 .00 .		16. 16. 16. 16. 16. 16. 16. 16. 16. 16.		36. 11. 57. 11. 54.	

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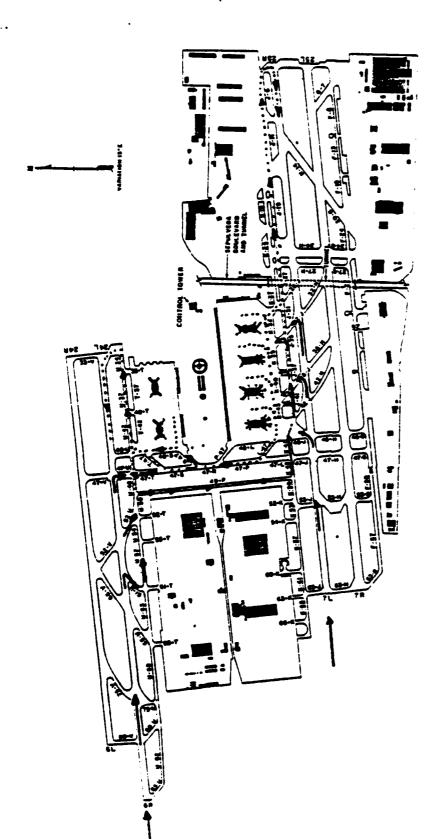
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A/C LATENESS DISTRIBUTION BY MINUTES (RANDOM NUMBER YERSUS TIME)

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Configuration B Figure 8

01/11/79 24L 25R	423 411 GURATION B				
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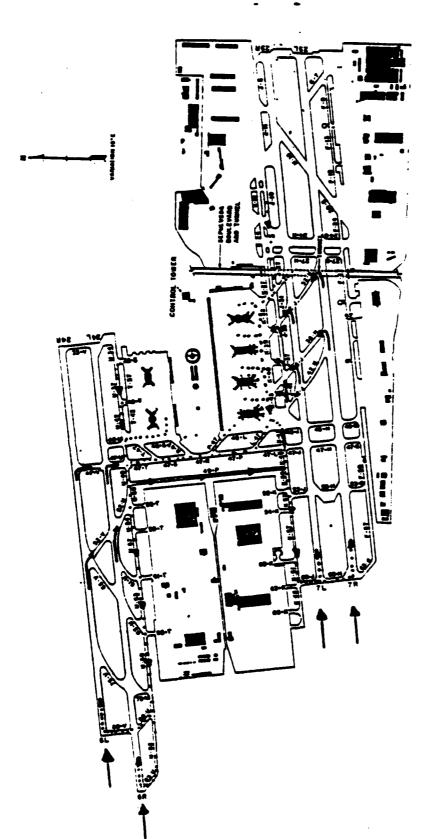
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27 PAGE 01/11/10



Configuration C Figure 9

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			'	261	289	256			282	282	202				195	20%	282
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#### Attachment C

INPUT DATA SUMMARY STAGE 1 EXPERIMENTS

Los Angeles International Airport

Los Angeles Airport Improvement Task Force Delay Studies

January 1979

# INDEX OF STAGE 1 EXPERIMENTS

√°	43	, <b>,</b>	So	6	
Sequence No.	Experiment No.	Study Case No.	Model	Type of Input Description	Page
1	1	1	ASM	Change-Sheet	38
2	7	1	11	n	47
3	11	1	11	11	49
4	13	1	tt	11	53
5	2	2	Ħ	11	56
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16	16	4	11	Change-Sheet	82

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LOS ANGELES DELAY EXPERIMENTS

																		•	ъ	•	r Light	
Near Tearm Improvements		None	None	None	None	None	None	None	None	None	None	None	1982	1982	2,3	5, 76+Change	5,7,8	None	Tunnel Construction	Tunnel Construction	Comments-Usage for Light	
ATC System scenario		197:8	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978	1982	1982	1982	1978	1978	1978	1982	1982	1982	
Demand		1978	1978	1978	1978	1978	1978	1982	1982	1982	1982	1982	1982	1982	1982	1982	1982	1978	1982	1982	1982	•
Weather		VFRI	IFRI	IFR2	VFRI	IFRI	VFRI	VFR1	IFRI	ÝFRI	VFRI	IFRI	VFRI	IFR1	VFRI	VFRI	VFRI	n. a.	VFRI	VFR1	VFRI	
Departure runwaye		24L, 24R, 25L, 25R	24L, 25R	24L, 25R	24L, 25R	24L, 25R	6L, 6R, 7L, 7R	24L, 24R, 25L, 25R	24L, 25R	6L, 6R, 7L, 7R	24L, 25R	24L, 25R	24L, 24R, 25L, 25R	24L, 25R	24L, 24R, 25L, 25R	24L, 25R	6L, 6R, 7L, 7R	n, a.	24L, 24R, 25L	24L, 24R, 25L, 25X	24L, 24R, 25L, 26	
Arrival		24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	24R, 25L	6R, 7L	6R, 7L	6L, 6R, 7L, 7R	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	6L, 6R, 7L, 7R	6R, 7L	6R, 7L	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	6R, 7L	6L, 6R, 7L, 7R	n.a.	24L, 24R, 25L	24L, 24R, 25L, 25x <sup>K</sup>	24L, 24R, 25L, 26	
Study		~	7	•	S	9	<b>~</b>	-	~	*	in	•	-	7	_	ĸ	•	n.	2	1	1	
Model	σ	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM,	ADM	RCM	RCM	RCM	plicable.
Experiment number	Stage l Experiments	- `*	; <b>~</b>		+-+	<b>v</b> n	•	×	1	•	- 01	104	=	21	13	15	16	17	17 A	17 B	17 C	n.a. = not applicable.

Study cases (combinations of runway use and weather conditions) are defined in Figure III-1.

FAA will describe impact of 1982 and post-1987 ATC systems on model inputs.

Potential near-term improvements are identified in the Los Angeles international Airport improvement Task Force interim Report, and in . . .

Task Force establishes packages of near-term improvements most likely to be implemented in 1982 and 1987 time frames. The 1982 package includes improvement # 2 (high-speed taxiway off Runway 25L to the south), improvement # 3 (strengthaning of the Sepuiveda Tunnel), (cont.) Airfield Simulation Model. 4 °

# Table 2 (continued)

- (cont.) new taxiway access to threshold of Runway 24R, and temporary holding areas on future Taxiway 75. The 1987 package includes all 1982 improvements plus Satellite 1, International Terminal, and/or remote parking for 20 aircraft at west end of airport. Those packages of improvements are subject to Task Force review and revision,
  - Impact of absence of Improvements # 2 and #3 (high-speed taxiway of Runway 25L and strengthening of the Sepulveda Tunnel).
- Improvement # 5 is a high-speed taxt exit off Runway 7. Improvement # 7 is a high-apped taxt exit to Taxiway 47 from Runway 6R. Improvement #8 is a bypass area on the north side of Runway 7L.
  - Annual Delay Model.
- Runway Capacity Model.
- Runway 25R closed for tunnel construction. ندندند
- During closure of 25R for tunnel construction, parts of Runway 25 are open for small sircraft arrivals and departures.

#### EXPERIMENT NO. 1

#### Objective:

To obtain baseline delay estimates for the following runway configuration in VFR-1 for 1978 demand.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Calibration was performed using this configuration ("A") (Inputs should be similar but with a 1978 demand).

Experiment 7 uses configuration "A" with 1982 demand.

- . Time period to be simulated
- Demand input distributions (arrival fix, runways, and gates)
- . Lateness distribution

C T	MILL STON MODEL PROPERTY	
21	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
	Title	Los Angeles Delay Exper - Stage 1
2.	Random number seeds	
3.	Start and finish times	Required Data from Task Force
4.	Print options	
5.		
6.		
7.	Truncation limits	
8.		
3. A1	rfield Physical Characteristics	Configuration "A"
9.	Airfield network	
10	Number of runways	
П.	Kunway Identification	
12.	The state of the s	
13.	Runway crossing links	
14.		
15.		
16.	Airline gates	
17.	General aviation basing areas	
. ATC	Procedures	
18.		
19.	Route data	
20.		
21.	Common approach paths	
22.	Vectoring delays	
23.	Departing runway queue control	
24.	Gate hold control	
<u>25.</u>	Departure airspace constraints	
20.	Departure queue	
27.		
	raft Operational Characteristics	
28. 29.	Exit taxiway utilization Arrival runway occupancy times	
<del>30.</del>		
31.	Touch-and-go runway occupancy times Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35	Aircrace travel times	
36.	Runway crossing times	
37.	Lateness distributions	Required Data from Task Force
38.	Demand	1978 Demand With Demand Input Dis-
		tributions (Required Data from Task

TABLE 3 % of Class 1: Arrival Fix/Runway Distribution

40

(YWR)	9 Ontario	ි Seal Beach	G Ventura	Fillmore	G Van Nuys	Northeast A Quadrant	Southeast Aquadrant	Northwest Quadrant	Southwest Quadrant
24R	36.8 (7)	5.3 (1)	5.3 (1)	52.6 (10)					
24L	53.8 (7)	7.7		38.5 (5)					
25R	100.0 (2)								
25L	89.3 (67)	10.7							

% of Class 2: Arrival Fix/Runway Distribution

(YWA)	⊖ ⊖ Ontario	Seal Beach	G Ventura	f. Fillmore	(KWA) (KWan Nuys	Northeast Z Quadrant	Southeast Guadrant	Z Northwest Ouadrant	© Southwest ∰Quadrant
24R	25.0 (6)	8.3 (2)	12.5 (3)	50.0 (12)	4.2 (1)				
24L	46.2 (6)	7.7 (1)	,	38.5 (5)	7.6 (1)				
25R	28.0 (63)	6.2 (14)	1.8 (4)	62.2 (140)	1.3	0.5 (1)			
25L	73.9 (128)	13.3 (23)		9.8 (17)	1.7		1.3 (2)		

% of Class 3: Arrival Fix/Runway Distribution

(YWS)	G Ontario	ට ර Seal Beach	G Ventura	Fillmore	S Van Nuys	g Northeast Quadrant	Southeast Quadrant	Northwest Quadrant	Southwest Quadrant
24R	28.1 (18)	21.9 (14)	32.8 (21)	12.5 (8)	3.0 2)	1.7 (1)			
24L	31.8 (7)	45.5 (10)	13.6 (3)		4.6 (1)	4.5 (1)			
25R	13.3 (2)	33.3 (5)	33.3 (5)	13.3 (2)	6.8 (1)	·			
25L	54.7 (23)	16.7 (7)	11.9 (5)	9.5 (4)		7.2 (3)			

% of Class 4: Arrival Fix/Runway Distribution

(YWR)	G Ontario	ධි Seal Beach	G Ventura	Fillmore	A Van Nuys	X Northeast Guadrant	රි පි Southeast Quadrant	S Northwest Quadrant	Southwest Quadrant
24R	33.3 (2)	33.3 (2)			33.4 (2)	,			
24L	50.0 (1)					50.0 (1)			
25R	100.0 (1)								
25L	33.3 (3)	44.5 (4)			11.1 (1)	11.1 (1)			

% of Class 1: Arrival and Departure Runway/Gate Distributions

	Arrivals				Departures				
Rwy	24R	24L	25R	25L	24R	24L	25R	25L	
Gate Area	(No.of Arcft)	( )	( )	( )	( )	( )	( )	( )	
1	1.1 (1)								
2	7.4 (7)	2.1 (2)		9.6 (9)		19.2 (48)	0.4 (1)		
3	6.4 (6)	1.1 (1)				10.4 (26)			
4	1.1 (1)	3.2 (3)		16.0 (15)	0.8 (2)	21.6 (54)		0.4 (1)	
5				6.4 (6)		8.4 (21)			
6	3.2 (3)			10.6 (10)	0.8 (2)	6.0 (15)		1.2 (3)	
7	1.1 (1)		1.1 (1)	19.1 (18)		8.8 (22)			
8		1.1 (1)		9.5 (9)	0.8 (2)	17.2 (43)	0.4 (1)		
9									
10						2.4 (6)			
11						0.8 (2)			
12							0.4 (1)		
13									

% of Class 2: Arrival and Departure Runway/Gate Distributions

		Arriva:	ls		Departures			
Rwy	24R	24L	25R	25L	24R	24L	25R	25L
Gate Area	(No.of Acft	( )	( )	( )		( )		( )
1	0.2 (1)		0.9 (4)	3.2 (14)	0.2 (1)	0.2 (1)	0.2 (1)	
2	1.4 (6)		0.2	1.8 (8)		7.3 (41)	2.5 (14)	0.2 (1)
3						3.2 (18)	0.2 (1)	0.4 (2)
4			1.6 (7)	2.5 (11)		0.2 (1)	7.4 (42)	2.8 (16)
5	0.7 (3)		5.4 (24)	7.3 (32)		3.0 (17)	9.0 (51)	3.7 (21)
6	1.4 (6)		15.2 (67)	11.3 (50)	1.4 (8)	5.5 (31)	12.0 (68)	2.8 (16)
7	0.7 (3)		17.5 (77)	5.7 (25)	1.4 (8)	5.7 (32)	7.8 (44)	3.0 (17)
8	0.2 (1)		7.9 (35)	6.3 (28)		2.6 (15)	8.5 (48)	2.8 (16)
9	0.2 (1)			0.5 (2)			0.5 (3)	0.5 (3)
10			0.2 (1)	0.5 (2)		0.4 (2)		0.7 (4)
11	2.0 (9)	0.5 (2)	0.7	1.1 (5)	0.5 (3)	0.2 (1)		
12			0.7 (3)	2.2 (10)			1.9 (11)	1.1 (6)
13							0.2 (1)	

Table 4 (continued)

# % of Class 3: Arrival and Departure Runway/Gate Distributions

	A		Departures					
Rwy	24R	24L	25R	25L	24R	24L	25R	25L
Gate Area	(No.of Acrft)	( )	( )	( )	( )	( )	( )	( )
1								
2					0.5			
3								
4			2.7 (4)	1.4 (2)		0.5		1.0 (2)
5				0.7	0.5		0.5 (1)	1.0 (2)
6			1.4 (2)	0.7			2.2 (4)	
7			1.4 (2)	1.4 (2)			0.5	
8					0.5	0.5 (1)		
9			2.0 (3)	18.3 (27)			10.3 (19)	18.9 (35)
10	0.7			3.4 (5)		0.5	0.5 (1)	1.0 (2)
11	51.0 (75)	13.5 (20)	0.7		16.2 (30)	10.8 (20)	19.5 (36)	14.1 (26)
12				0.7			0.5 (1)	
13								

## Table 4 (continued)

# % of Class 4: Arrival and Departure Runway/Gate Distributions

	Arrivals				Departures			
Rwy	24R	24L	25R	25L	24R	24L	25R	25L
Gate Area	(No.of Acrft)	( )		( )	( )	( )		
1								
2								
3					·			
4								
5								
6								
7								
8								
9			5.9 (1)	5.9 (1)	2.2 (1)	2.2 (1)		27.3 (12)
10	5.9 (1)				2.3 (1)	2.3 (1)	2.3 (1)	
11	64.7 (11)	17.6 (3)			22. <b>7</b> (10)	18.2 (8)	6.8 (3)	11.4 (5)
12								2.3 (1)

Table 5

ARRIVAL AIRCRAFT LATENESS DISTRIBUTION (Average deviation from schedule, excluding delays due to destination airport)

Amount of time late or early	Percent of flights late or early (%)
More than 15 min. early	0
less than 15 min. early	5
On time	24
less than 5 minutes late	29
5 to 10 minutes late	15
10 to 15 minutes late	9
15 to 30 minutes late	9
30 to 45 minutes late	4
45 to 60 minutes late	$\dot{2}$
more than 60 minutes late	3

Source: Peat, Marwick, Mitchell & Co., analysis of data provided by Stapleton Task Force

#### EXPERIMENT NO. 7

#### Objective:

To obtain baseline delay estimates for the following runway configurations in VFR 1 for 1982 demand.

To obtain delay estimates for 1982 with no improvements to the airport.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Experiment 11 is similar with an improved ATC system scenario (1982) and the 1982 near-term improvements.

Prior Experiment 1 is similar for the 1978 demand.

- . Demand input distributions
- . Lateness distribution

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	
<ol> <li>Truncation limits</li> </ol>	
8. Time switch	
B. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	
ii. Runway identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
<pre>16. Airline gates</pre>	
<ul><li>17. General aviation basing areas</li><li>C. ATC Procedures</li></ul>	
18. Aircraft separation	
19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control  D. Aircraft Operational Characteristics	
28. Exit taxiway utilization 29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy t	
31. Departure runway occupancy time	JMAC
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airspace travel times	
36. Runway crossing times	
<ol><li>Lateness distributions</li></ol>	
38. Demand	1982 Demand with Demand Input

#### EXPERIMENT NO. 11

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and the 1982 near-term improvements.

#### ARRIVAL RUNWAYS

#### DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Experiment 13 is identical less improvements #2 (high-speed taxiway off runway 25L) and improvements #3 (strengthening of the Sepulverda tunnel).

Prior Experiment 7 is similar without the noted improvements.

Prior Experiment 1 is similar without the noted improvements and a 1978 demand.

- 1982 near-term improvements
- . 1982 demand input distributions

SIM	ULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Log	istics	
].	Title	
2.	Random number seeds	
3.	Start and finish times	
	Print options	
5.	Airline names	
6.	Processing options	
7.	Truncation limits	
8.	Time switch	
	field Physical Characteristics	Configuration "A"
9.	Airfield network	
10	Number of runways	
11.	Kunway identification	
12.	Departure runway and links	See Attached Figure for Access to 24P
		See Attached Flours for Access to 748
14.	Exit taxiway location	Societa ched Diversión de
15.	Holding areas	See attached Figure for Improvement # 2
16.	<del></del>	See attached figure for Improvement to Taxiwa
17.		
	General aviation basing areas Procedures	
19.	Aircraft separation Route data	
	Two-way path data	New route data to reflect improvements
	Common approach paths	
22.	Vectoring delays	
23.		
	Departing runway queue control Gate hold control	
	Departure airspace constraints Departure queue	
27.	Runway crossing delay control	
	aft Operational Characteristics	
	Exit taxiway utilization	New End Close 4 Pers 4 Persh at a cons
	Arrival runway occupancy times	New Exit Class 4 Rwv 4 Prob. of use 0.2
30.	Touch-and-go runway occupancy time	
31.	Departure runway occupancy times	
	Taxi speeds	
	Approach speeds	
	Gate service times	
32.	Airchace travel times	
	Runway crossing times	
	Lateness distributions	
37.	careness aistributions	•

TABLE 6
PRE-1985 VFR SEPARATION VALUES\*

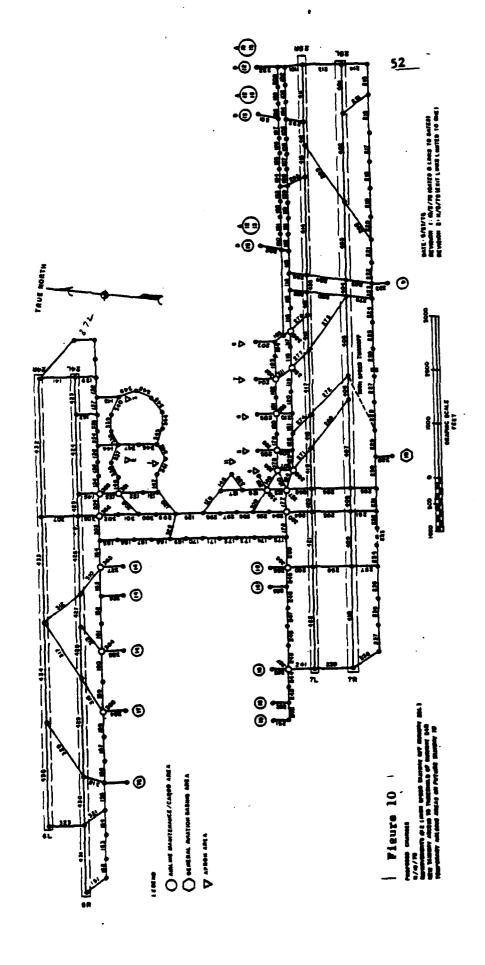
# A. Arrival-Arrival Separation (nmi) - VFR - Without Buffer

		Trail Aircraft Class				
		A	В	С	D	
Lead Aircraft Class	A B C D	1.9 1.9 2.7 4.0	1.9 1.9 2.7 4.0	1.9 1.9 1.9 3.0	1.9 1.9 1.9 2.7	

# B. Departure-Departure Separations (seconds) - VFR

		Trail	Airc	raft Class	
		A	В	С	D
Lead Aircraft Class	A B C D	35 35 50 120	35 35 50 120	45 60	50 50 60 90

<sup>\*</sup> The separations shown are minimum values.



#### EXPERIMENT NO. 13

#### Objective:

To assess the delay impact to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and the 1982 near-term improvement less improvement #2 and #3.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

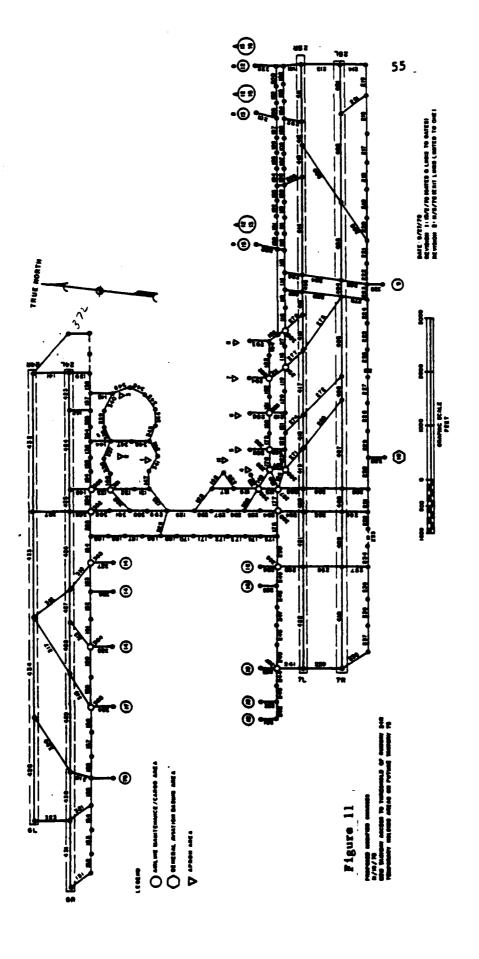
#### Related Comparison Experiments:

Prior Experiment 11 is similar except improvements #2 and #3 are included in run.

#### Remaining Data Items:

None

SII	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
	Title	
2.	Random number seeds	
3	Start and finish times	
5.	Print options Airline names	
6.	Processing options	
<del></del>	Truncation limits	
8.	Time switch	
	rfield Physical Characteristics	Configuration "A"
9.	Airfield network	
10	Number of runways	
11.		
12.	Departure runway and links	
13.	Runway crossing links	
14.	Exit taxiway location	
15.	Holding areas	
16.	Airline gates	
17.		
	Procedures	
	Aircraft separation	
19.	Route data	Less Improvement #2 and # 3
20.	Two-way path data	Tess IIIII Properties
21.	Common approach paths	
22.	Vectoring delays	
23.	Departing runway queue control	
24.	Gate hold control	
25.	Departure airspace constraints	
26.	Departure queue	
27.	Runway crossing delay control	
D. Airc	raft Operational Characteristics	
28.	Exit taxiway utilization	Less Improvement Exit
29.	Arrival runway occupancy times	
30.	Touch-and-go runway occupancy time	
31.	Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35_	Airspace travel times	
<u>36.</u>	Runway crossing times	
37.	Lateness distributions	
38.	Demand	Restrict Heavy Aircraft (Class 1) to Runways 24R and 24L (noise restriction on 24L)



#### EXPERIMENT NO. 2

#### Objective:

To obtain baseline delay estimates for the following runway configuration in IFR 1 for 1978 demand.

ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24L, 25R

## Related Comparison Experiments:

Experiment 8 is identical except for a 1982 demand. Experiment 3 is similar with IFR 2 weather conditions and restriction on arrival runway use.

- . IFR 1 values for arrival runway occupancy times and new lateness distributions
- . Demand input distributions for departure runways and gates

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	†
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	
B. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	
100000111000000	
12. Departure runway and links	No Departures on 24R and 251
13. Runway crossing links	
14. Exit taxiway location 15. Holding areas	<del> </del>
16. Airline gates	
17. General aviation basing areas C. ATC Procedures	<del></del>
18. Aircraft separation	IFR 1 Weather Conditions
19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
27. Runway crossing delay control	
27. Runway crossing delay control D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	IFR 1 Values
30. Touch-and-go runway occupancy time	\ <u>````````````````````````````````````</u>
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
25 Airchace travel times	
36. Runway crossing times 37. Lateness distributions	
38. Demand	Shift Dana sture demand from 245 to 245
JO. DEHICITU	Shift Departure demand from 24R to 24L and 25 L to 25R

Table 7

## C. ATC PROCEDURES

18. <u>Aircraft Separations</u>: These values are based on Report No. FAA-EM-78-8A.

# Arrival-Arrival Separation (nmi) - IFR - Without Buffer

		Trai	Trail Aircraft Class				
		4	3	2	1		
		(A)	(B)	(C)	(D)		
Lead 4	(A)	3.0	3.0	3.0	3.0		
Aircraft 3	(B)	3.0	3.0	3.0	3.0	3 3	
	(C)		3.04.0	3.0	3.0	-	
	(D)	6.0	5.040	5.0	4.0		

# Departure-Departure Separations (seconds) - IFR

			Tra	il Air	craft	Class
			4	3	2	1
			(A)	(B)	(C)	(D)
Lead	4	(A)	60	60	60	60
Aircraft	3	(B)	60	60	60	60
Class	2	(C)	60	60	60	60
	1	(D)	120	120	120	90

<sup>\*</sup>The separations shown are minimum values.

Departure/Arrival separations assume VFR values + 0.5 nmi. Arrival/Departure separations assume IFR runway occupancy time equals VFR runway occupancy time + 5 seconds.

#### EXPERIMENT NO. 8

#### Objective:

To obtain baseline delay estimates for the following runway configurations in IFR 1 for 1982 demand.

To obtain delay estimates for 1982 with no improvements to the airport.

#### ARRIVAL RUNWAYS

#### DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24L, 25R

#### Related Comparison Experiments:

Experiment 12 is identical but with an improved ATC system scenario and the 1982 near-term improvements.

Prior Experiment #2 is identical except for a 1978 demand.

#### Remaining Data Items:

1982 demand input distributions (arrival fix, runways, and gates)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	
B. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	
11. Runway identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
16. Airline gates	
17. General aviation basing areas	
C. ATC Procedures	
18. Aircraft separation	
20. Two-way path data 21. Common approach paths	
22. Vectoring delays	ļ ————————————————————————————————————
23. Departing runway queue control 24. Gate hold control	
25. Departure airspace constraints 26. Departure queue	
27. Runway crossing delay control D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy time	
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airchace travel times	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	1982 Demand with Arrival Fix and Runway
	Distributions (Required from Task Force)

#### EXPERIMENT NO. 12

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in IFR 1 with an improved ATC system scenario and the 1982 near-term improvements.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24L, 25R

#### Related Comparison Experiments:

Prior Experiment #8 is similar except for the noted improvements.

#### Remaining Data Items:

. Arrival demand distributions for heavys (arrival fix, runways, and gates)

SI	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
1	_Title	
2.	Random number seeds	
3	Start and finish times	
5.	Print options Airline names	
<u>6.</u>	Processing options Truncation limits	
8.		
	rfield Physical Characteristics	
		Configuration "A"
10	Airfield network	
11.	Number of runways Kunway identification	
	<del></del>	
	Departure runway and links	See Attached Figure for Access to 24R
13.	Talling of 0331119 Tilling	
14.	Exit taxiway location	See Attached Figure for Improvement # 2
15.		Ser Attached Figure for Improvement to Taxiva
16.	Airline gates	(12)
17. C. ATC	General aviation basing areas Procedures	
18.	Aircraft separation	
19.	Route data	New Route Data to Reflect Improvements
20.	Two-way path data	
21.	Common approach paths	
22.	Vectoring delays	
23.	Departing runway queue control	
24.		
25.	Departure airspace constraints	
	Departure queue	
27.	Runway crossing delay control	
). Airc	raft Operational Characteristics	
_ 28.	Exit taxiway utilization	New Exit Class 4 Rwy 4 Prob. of use 0.28
29.	Arrival runway occupancy times	
30.	Touch-and-go runway occupancy time	c
31.	Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35	Airspace travel times	
36.	Runway crossing times	
37.	Lateness distributions	
38.	Demand	Demand Distribution for Heavy Aircraft
	KUNNIN.	Shared by 25L and 25R

#### EXPERIMENT NO. 3

#### Objective:

To obtain baseline delay estimates for the following runway configuration in IFR 2 with 1978 demand.

ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 25L

24L, 25R

#### Related Comparison Experiments:

Prior Experiment 2 is similar except for IFR 1 conditions.

- . IFR 2 separation values and lateness distributions
- . Arrival demand distributions
- . IFR 2 arrival runway occupancy times

Demand)

38.

Demand

No Arrivals on 24L and 25R (Shift Arrival

#### EXPERIMENT NO. 4

#### Objective:

To obtain baseline delay estimates for the following runway configuration in VFR 1 for 1978 demand for nighttime operations.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

6R, 7L

24L, 25R

# Related Comparison Experiments:

Experiment 5 is identical except for IFR 1 weather conditions.

Experiment 10 is identical except for 1982 demand.

- . New model inputs (See configuration B)
- . Demand input distributions
- Time of simulation (0000 (a.m.) to 0600 (a.m.)) (0500 G.m.t. to 1100 G.m.t.)
- VFR 1 (special) separations for departure/arrival dependency on 6R-24L, 7L-25R

New )

SIMULATION MODEL INPUT DESCRIPTION OF INPUT CHANGE Logistics Title Random number seeds Start and finish times Print options 5. Airline names 6. Processing options Truncation limits Time switch Airfield Physical Characteristics Configuration "R" Airfield network 10 Number of runways II. Kunway identification 12. Departure runway and links Runway crossing links 14. Exit taxiway location T5. Holding areas 16. Airline gates General aviation basing areas 17 C. ATC Procedures Aircraft separation VFR1 (Special) 19. Route data 20. Two-way path data Common approach paths 22. Vectoring delays Departing runway queue control Gate hold control Departure airspace constraints 26. Departure queue Runway crossing delay control D. Aircraft Operational Characteristics Exit taxiwav utilization New Data from night time data collecti Arriva: runway occupancy times New Data from night time data collection **3**0. Touch-and-go runway occupancy times 31. Departure runway occupancy times Taxi\_speeds 33. Approach speeds 34. Gate service times 35 Airchace travel times 36. Runway crossing times. 37. Lateness distributions 38. Demand 1978

RUNWAY 7L

OBSERVED PROBABILITY OF USE

EXIT LINK NO. (NUMBER OF AIRCRAFT)

AVERAGE RUNWAY OCCUPANCY (SEC)

CLASS	274	277	278	282	260	286
l (D)						
2 (C)	0.67 (10) 60		0.20 (3) 66	0.07 (1) 76		0.06 (1) 76
3 (B)	0.25 (1) 64	0.25 (1) 63		0.25 (1) 139	0.25 (1) 42	
4 (A)				D DDODARY	1.00 (1) 42	

RUNWAY 6R

EXIT LINK NO.

OBSERVED PROBABILITY OF USE

(NUMBER OF AIRCRAFT)

AVERAGE RUNWAY OCCUPANCY (SEC)

CLASS	310	305	145		
1 (D)	.30 (3) 47	.40 (4) 70	.30 (3) 70·		
2 (C)	.54 (13) 48	.37 (9) 61	.09 (2) 75		
3 (B)					
4 (A)					

#### EXPERIMENT NO. 10

# Objective:

To obtain baseline delay estimates for the following runway configurations in VFR 1 for 1982 demand.

To obtain delay estimates for 1982 with no improvements to the airport.

#### ARRIVAL RUNWAYS

#### DEPARTURE RUNWAYS

6R, 7L

24L, 25R

#### Related Comparison Experiments:

Experiment 10A is identical except for IFR 1 weather conditions.

Experiment 15 is identical except for near-term improvements #5 and #7

Prior Experiment 4 is identical except for 1978 demand.

#### Remaining Data Items:

. Demand input distributions

10 (Input changes from experiment number

SI	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
1.	Title	
2.	Random number seeds	
3.	Start and finish times	
4.	Print options	
5.	Airline names	
6.		
7.	Truncation limits	
8.	Time switch	
B. AT	rfield Physical Characteristics	Configuration "B"
9.	Airfield network	
10	Number of runways	
<del></del>	Runway identification	
12.	Departure runway and links	
13.	Runway crossing links	
14.		
15.	Holding areas	
	Airline gates	<u> </u>
17.	General aviation basing areas	
_	Procedures	
18.	Aircraft separation Route data	
ļ		
20. 21.	Two-way path data Common approach paths	
22.	Vectoring delays	
23.		
24.	Departing runway queue control Gate hold control	
25.		
26.	Departure airspace constraints Departure queue	
27.	Runway crossing delay control	
	raft Operational Characteristics	
28.	Exit taxiway utilization	
29.	Arrival runway occupancy times	
30.	Touch-and-do runway occupancy time	
31.	Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35	Airspace travel times	
36. 37.	Runway crossing times	
	Lateness distributions	
38.	Demand	1982 Demand

# EXPERIMENT NO. 15

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved 1978 ATC system scenario and near-term improvements #5 and #7 for nighttime operations.

#### ARRIVAL RUNWAYS

## DEPARTURE RUNWAYS

6R, 7L

24L, 25R

#### Related Comparison Experiments:

Prior Experiment 10 is similar without the noted improvements.

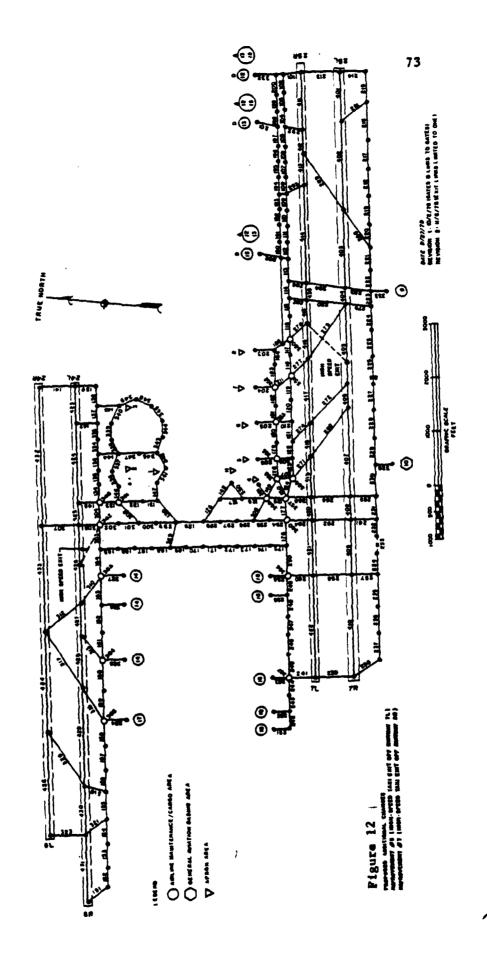
#### Remaining Data Items:

Bypass area north of runway 7L Improvement #8 omitted from this experiment. (Must be defined by Task Force)

#### New Exit Probabilities

Runway 6R (Combining link exits 310 & 305)	Runway 7R
Class 1 - 0.70	Class 1 - 0.87
Class 2 ~ 0.99	Class 2 - 0.87
Class 3 ~ 0.99	Class 3 - 0.50
Class 4 - 0.99	Class 4 - 0.50

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
. Logistics	
1. Title	
2. Random number seeds	
3. Start and finish times	
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	
Airfield Physical Characteristics	Configuration "B"
9. Airfield network	
10 Number of runways	
11. Kunway Identification	
12. Departure runway and links	
13. Runway crossing links	New Routes for Improvement #5 & #7
14. Exit taxiway location	New Exit for Improvements # 5, & #7
15. Holding areas:	
16. Airline gates	
17. General aviation basing areas	
ATC Procedures	
18. Aircraft separation	
19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control	
Aircraft Operational Characteristics	
28. Exit taxiway utilization	New Values for Exit Utilization
29. Arrival runway occupancy times	New Exit
3U. Touch-and-go runway occupancy tim	nes .
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airspace travel times	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	



# EXPERIMENT NO. 5

# Objective:

To obtain baseline delay estimates for the following runway configuration in IFR1 for 1978 demand.

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

6R, 7L

24L, 25R

# Related Comparison Experiments:

Experiment # 10A is identical except for the 1982 demand.

- . Demand Input Distributions
- . IFR 1 Separations

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
1. Title 2. Random number seeds	
3. Start and finish times	
4. Print options 5. Airline names	
6. Processing options 7. Truncation limits	
8. Time switch b. Airfield Physical Characteristic	
	Configuration "R"
9. Airfield network 10. Number of runways	
10 Number of runways 11. Runway identification	
12. Departure runway and links	
Manuay crossing rinks	
14. Exit taxiway location 15. Holding areas	
16. Airline gates	
17. General aviation basing area C. ATC Procedures	35
18. Aircraft separation	IFR 1 (Special) departure / arrival depen-
19. Route data	dency to be developed
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue contr	-01
24. Gate hold control	
25. Departure airspace constrain	its
26. Departure queue	
27. Runway crossing delay contro	
D. Aircraft Operational Characterist	ics
28. Exit taxiway utilization 29. Arrival runway occupancy tim	
<b>(()</b>	ند و بروی این <sup>ب</sup> در از برای و از داده ای بروی و از با بروی برای با بروی و از با از در داده و از این از این از ا
Jouch-and-do runway occupanc	
	ines
32. Taxi speeds 33. Approach speeds	
34. Gate service times	
34. Gate service times 35. Airsnace travel times	
34. Gate service times 35. Airspace travel times 36. Runway crossing times	
34. Gate service times 35. Airsnace travel times	

#### EXPERIMENT NO. 10A

#### Objective:

To obtain baseline delay estimates for the following runway configuration in IFR 1 for 1982 demand.

To obtain delay estimates for 1982 with no improvements to the airport.

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

6R, 7L

24L, 25R

### Related Comparison Experiments:

Prior Experiment 5 is similar with a 1978 demand.

- . 1982 Demand
- . Demand input distribution

١,	MU ATTON MODEL TARREST	
21	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
	Title	
2.	Random number seeds	
3.	Start and finish times	
4.	Print options	
5.		
6.	Processing options	
7.		
8. B. Al	Time switch rfield Physical Characteristics	
J. 71		Configuration "B"
10	Airfield network	<u> </u>
10	Number of runways Runway identification	
	<del></del>	
12.	Departure runway and links Runway crossing links	<del> </del>
	وبالوالة فيواوي التراسيس والبارات والمانو والمراس أسود والأناب الأوالية والمتكون المتحدث والمتحدث	
14.	Exit taxiway location Holding areas	
16.	Airline gates	
17.	فالتراز المراوات والمراوات والمراوات والمراوات والمراوات والمراوات والمراوات والمراوات والمراوات والمراوات	
	General aviation hasing areas Procedures	<del></del>
	Aircraft separation	<del></del>
19.	Route data	
20.	Two-way path data	
21.	Common approach paths	
22.	Vectoring delays	
23.	Departing runway queue control	
24.	Gate hold control	
25.	Departure airspace constraints	
26.	Departure queue	
27.	Runway crossing delay control	
	raft Operational Characteristics	
28. 29.	Exit taxiway utilization Arrival runway occupancy times	
30.	Touch-and-go runway occupancy times	
31.	Departure runway occupancy times	2
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35	Airspace travel times	
36.	Runway crossing times	
37.	Lateness distributions	
38.	Demand	1982

#### EXPERIMENT NO. 6

#### Objective:

To obtain baseline delay estimates for the following runway configuration in VFR 1 for 1978 demand for east operations.

#### ARRIVAL RUNWAYS

#### DEPARTURE RUNWAYS

6R, 6L, 7R, 7L

6R, 6L, 7R, 7L

#### Related Comparison Experiments:

Experiment #9 is identical except for the 1982 demand.

- . New model inputs (See configuration C)
- . Demand input distributions
- . Time of simulation

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	Required from Task Force
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	<del> </del>
B. Airfield Physical Characteristics	Configuration "C"
9. Airfield network	
10 Number of runways 11. Kunway identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
16. Airline gates	
17. General aviation basing areas	
C. ATC Procedures	
18. Aircraft separation	
19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control	
D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy tim	200
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airspace travel times	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	1978 Demand and Demand Input Distribu-
	tions (Required from Task Force)
	<u> </u>

#### EXPERIMENT NO. 9

#### Objective:

To obtain baseline delay estimates for the following runway configurations in VFR 1 for 1982 demand for east operations.

To obtain delay estimates for 1982 with no improvements to the airport for east operations.

# ARRIVAL RUNWAYS

#### DEPARTURE RUNWAYS

6R, 6L, 7R, 7L

6R, 6L, 7R, 7L

# Related Comparison Experiments:

Experiment #16 is identical except for near-term improvements #5, #7, and #8.

Prior Experiment #6 is similar with a 1978 demand.

#### Remaining Data Items:

. New model inputs (See configuration C)

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	
b. Airfield Physical Characteristics	Configuration UCU
9. Airfield network	
10 Number of runways	
II. Kunway identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
16. Airline gates	
17. General aviation basing areas	
C. ATC Procedures	•
18. Aircraft separation	
19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
20. Departure queue	
27. Runway crossing delay control	
. Aircraft Operational Characteristics	
28. Exit taxiway utilization 29. Arrival runway occupancy times	
(I)	
31. Departure runway occupancy times	
The same of the sa	
32. Taxi speeds 33. Approach speeds	
34. Gate service times	
35 Airspace travel times 36. Runway crossing times	
37. Lateness distributions	
38. Demand	1982 Demand and Domand Tanua District
	1982 Demand and Demand Input Distri- outions (Required from Task Force)

#### EXPERIMENT\_NO. 16

# Objective:

To assess delays to aircraft in two of the following runway configurations in VFR 1 with near-term improvements #5, #7, and #8 for east operations.

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

6R, 6L, 7R, 7L

6R, 6L, 7R, 7L

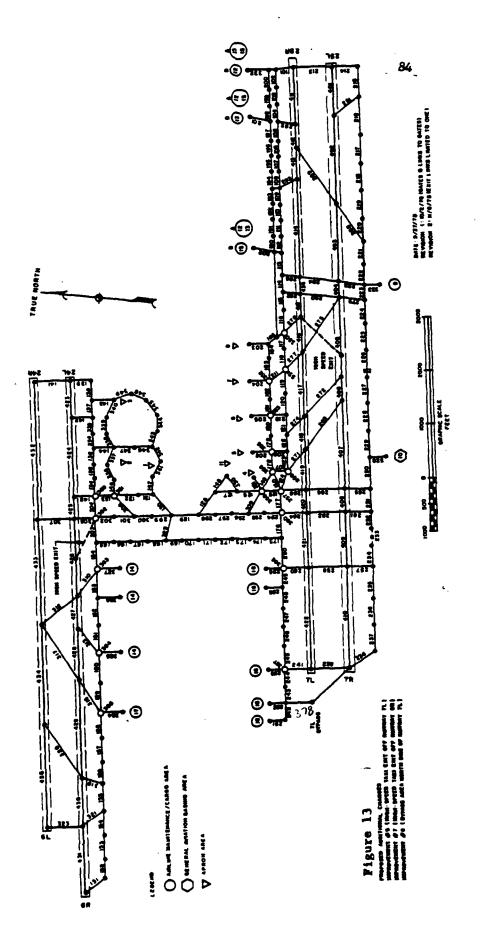
# Related Comparison Experiments:

Prior Experiment #9 is identical except for noted improvements to the airport.

# Remaining Data Items:

. By pass area on Runway 7L Must be defined by Task Force

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
	SESSITE FOR SETTINGS
1. Title 2. Random number seeds	
The state of the s	
<ol><li>Start and finish times</li></ol>	
4. Print options 5. Airline names	
<ul><li>6. Processing options</li><li>7. Truncation limits</li></ul>	
8. Time switch  B. Airfield Physical Characteristics	
	Configuration "C"
9. Airfield network 10 Number of runways	
10 Number of runways 11. Runway identification	
والمساوية والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة والمنافقة	
12. Departure runway and links	
namay crossing rinks	
14. Exit taxiway location 15. Holding areas	
17. General aviation basing areas C. ATC Procedures	
18. Aircraft separation	
19. Route data	New Routes for 7L
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control	
D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
LOUCH-and-do runway occupancy ti	me s
31. Departure runway occupancy times	
32. Taxi speeds 33. Approach speeds	
34. Gate service times	
36. Runway crossing times	- t
37. Lateness distributions 38. Demand	



#### Attachment D

# PRELIMINARY MODEL INPUT DATA FOR STAGE 2 EXPERIMENTS

Los Angeles International Airport

Los Angeles Airport Improvement Task Force Delay Studies

January 1979

# LOS ANGELES DELAY EXPERIMENTS Table 10

Near-term :		101	II III	Terminal Expansion <sup>n</sup>	Remote Terminal	Tunnel ConstructionP	Dual TaxiwayP	Tunnel Construction 25R	Tunnel Construction 25L	1987	1987 * Change	1982	None	1982	None	1987	None	1987	None	
ATC System scenario		1982	1982	1982	1982	1978	1978	1978	1978	1987	1987	1982	1982	1978	1978	1987	1987	1978	1988	
Demand		1982	1982	1982	1982	1978	1982	1978	1978	1987	1987	1982	1982	1982	1982	1987	1987	1987	1987	
Weather		R VFRI	R VFR1	R VFR1	R VFR1	VFRI	VFRI	IFRI	IFRI	R VFRI	IFRI	n, a	n.	D. 2.	n. a.	n. a.	n.a.	n. a.	n. a.	
Departure Runways		24L, 24R, 25L, 25R V	24L, 24R, 25L, 25	24L, 24R, 25L, 25	241,, 24R, 25L, 25	24L, 24R, 25L	24L, 24R, 25L	24L, 25L	24L, 25R	24L, 24R, 25L, 25R		n.a.	n.a.	n.a.	n. a.	n.a.	n.a.	n, a.	п. а.	
Arrival Runways	·	24L, 24R; 25L, 25R	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	24L, 24R, 25L	24L, 24R, 25L	24R, 25L	24R, 25R	24L, 24R, 25L, 25R	24L, 24R, 25L, 25R	n.a.	n. B.	. a.	n. a.	n.a.	n, a,	n. 2.	n. s.	
Study		-	_		~	7	<b>œ</b>	<b>6</b>	6	_	7	n. a.	n.	n. a.	n. a.		n. 2	n. 4.	n. a.	
Model		ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ASM	ADM	ADM	ADM	ADM	ADM	ADM	ADM	ADM	
Experiment	Stage 2 Experiments	18	19	07	12	22	22A	23	24	52	97	. 27	28	53	30	31	32	33	34	

Improvement #10 consists of a series of taxiway improvements identified in Appendix B. ∴ Ė

Improvement #11 contains temporary holding areas on present Taxiway 47 west of Satellites 3 and 4. The need for this experiment will be reviewed by the Task Force after consideration of temporary holding areas on future Taxiway 75.

The need for this experiment will be reviewed by the Task Force after consideration Construction of Satellite I and International Terminal. of future airline terminal locations. Ë

Remote parking for 20 aircraft at west end of Airport.

Additional experiment may be needed to test value of dual taxiway system around Satellite 4 during tunnel constructionl . d

LAX
INDEX OF STAGE 2 EXPERIMENTS

Sequence Number	Experiment Number	Study Case Number	Model	Type of Input Description	Page
1	18	1	ASM	Change-sheet	87
2	19	1	ASM	Change-sheet	89
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4	21	1	ASM	Change-sheet	93
5	25	1	ASM	Change-sheet	95
6	26	2	ASM	Change-sheet	97
7	22	7	ASM	Change-sheet	99
8	22A	8	ASM	Change-sheet	101
9	23	8	ASM	Change-sheet	103
10	24	8	ASM	Change-sheet	105

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# EXPERIMENT NO. 18

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and improvement #10 (taxiways).

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

# Related Comparison Experiments:

Experiment #19 is identical except for improvement #11 (temporary holding areas on taxiway 47 west of satellites 3 and 4).

Prior Experiment #11 is identical except for improvement #10 (taxiway improvements).

# Remaining Data Items:

. New route structure

		The state of the s
SI	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
٦.		
2.	Random number seeds	
3.	Start and finish times	
1	Print options	
5.	Airline names	
6.	Processing options	
7.	Truncation limits	
8.		<del> </del>
	rfield Physical Characteristics	Consideration
		Configuration "A"
9.	Airfield network Number of runways	
, -	Kunway Identification	<u> </u>
12.		
	Runway crossing links	
14.		<u> </u>
15.	Holding areas	
16.	Airline gates	
17.	General aviation basing areas	
C. ATC	Procedures	
18.	Aircraft separation	
19.	Route data	New routes
20.		
21.	Common approach paths	
22.	Vectoring delays	
23.	Departing runway queue control	
24.	Gate hold control	
25.	Departure airspace constraints	
26.	Departure queue	
27.	Runway crossing delay control	
	raft Operational Characteristics	
28.	Exit taxiway utilization	
29.	Arrival runway occupancy times	
<i>3</i> 0.	Touch-and-go runway occupancy time	
31.	Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35		
36.	Airspace travel times Runway crossing times	
37.	Lateness distributions	
38.		
30.	Demand	

#### LAX\_-STAGE 2

#### EXPERIMENT NO. 19

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and improvement #11 (temporary holding areas on taxiway 47).

ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

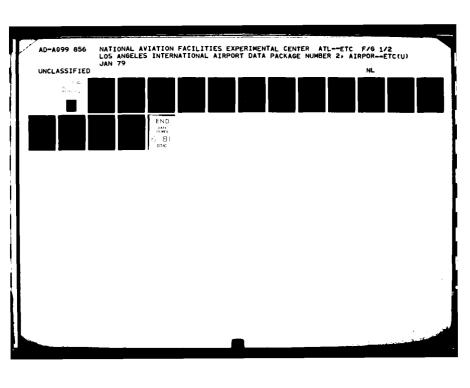
Experiment #20 is identical except for terminal expansion. (Construction of satellite 1 and international terminal)

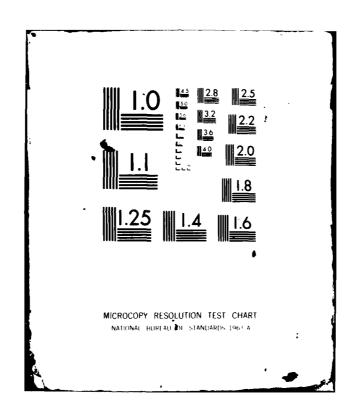
Prior Experiment #18 is identical except for improvement #11 (temporary holding areas on taxiway 47 west of satellites 3 and 4).

#### Remaining Data Items:

New holding area (on present taxiway 47 west of satellites 3 and 4)

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SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	
7. Truncation limits	
8. Time switch	
B. Airfield Physical Characteristics	Configuration 'A'
9. Airfield network	
10 Number of runways	<u> </u>
II. Kunway identification	
12. Departure runway and links	
Manuay Crossing Tinks	
14. Exit taxiway location 15. Holding areas	
	New holding area
16. Airline gates	
17. General aviation basing areas C. ATC Procedures	
18. Aircraft separation 19. Route data	
20. Two-way path data	
21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control	
D. Aircraft Operational Characteristics	
28. Exit taxiway utilization 29. Arrival runway occupancy times	
(II	
louch-and-do runway occupancy time	5
The state of the s	
32. Taxi speeds 33. Approach speeds	
34. Gate service times	
35 Airspace travel times	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	





#### EXPERIMENT NO. 20

#### Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and terminal expansion.

ARRIVAL RUNWAYS

24R, 24L, 25R, 25L

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Experiment #21 is identical except for remote parking for 20 aircraft at west end of airport.

Prior Experiment #19 is identical except for terminal expansion.

- New demand distributions (Gate area assignments)
- New route structure

	SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A.	Logistics	
	1. Title	
_	2. Random number seeds	
	3. Start and finish times	
	4. Print options	
	5. Airline names	
	6. Processing options	
	7. Truncation limits	
	8. Time switch	
В.	Airfield Physical Characteristics	Configuration "A"
	9. Airfield network	
	0 Number of runways	
	1. Kunway Identification	
1	2. Departure runway and links	
	3. Runway crossing links	
]	4. Exit taxiway location	
	5. Holding areas	
1	6. Airline gates	
	7. General aviation basing areas	
C. A	TC Procedures	
	8. Aircraft separation	
	9. Route data	New routes
	O. Two-way path data	
	1. Common approach paths	
2	2. Vectoring delays	
	3. Departing runway queue control	
2	4. Gate hold control	
	5. Departure airspace constraints	
	6. Departure queue	
	7. Runway crossing delay control	
	ircraft Operational Characteristics	
	8. Exit taxiway utilization 9. Arrival runway occupancy times	
L	<ul> <li>Touch-and-go runway occupancy times</li> <li>Departure runway occupancy times</li> </ul>	
	2. Taxi speeds	
	3. Approach speeds	
	4. Gate service times	
	5 Airchara traval times	
	6. Runway crossing times	
	7. Lateness distributions	
	8. Demand	New demand distribution
	<u> </u>	

#### EXPERIMENT NO. 21

# Objective:

To assess delays to aircraft in 1982 for the following runway configuration in VFR 1 with an improved ATC system scenario and remote parking for 20 aircraft.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Prior Experiment #20 is identical except for remote parking for 20 aircraft at west end of airport.

- New route structure (Gate area assignments)
- . New demand distribution

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
3. Start and finish times	
4. Print options 5. Airline names	
6. Processing options	
/. Truncation limits	
8. Time switch	
B. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	
11. Runway Identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	<del> </del>
15. Holding areas	
16. Airline gates	
` <del></del>	
17. General aviation basing areas C. ATC Procedures	
18. Aircraft separation 19. Route data	
	New routes to gate area
20. Two-way path data	
21. Common approach paths	<u></u>
22. Vectoring delays	
23. Departing runway queue control	
24. Gate hold control	
25. Departure airspace constraints	
26. Departure queue	
27. Runway crossing delay control	
D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy tim	
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airenaca travel time	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	New demand distribution
38. Demand	New demand distribution

# EXPERIMENT NO. 25

#### Objective:

To assess delays to aircraft in 1987 for the following runway configuration in VFR 1 with an improved 1987 ATC system scenario and 1982 improvements plus the satellite terminal and/or remote parking for 20 aircraft.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25R, 25L

24R, 24L, 25R, 25L

#### Related Comparison Experiments:

Prior Experiment #11 is identical except for the improvements from 1982 to 1987 and the demand.

#### Remaining Data Items:

Demand distributions

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
	DESCRIPTION OF INPUT CHANGE
2. Random number seeds .	
3. Start and finish times	
4. Print options	
5. Airline names	
6. Processing options	<u> </u>
/. Truncation limits	<u> </u>
8. Time switch  B. Airtield Physical Characteristics	<u> </u>
B. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	<u> </u>
11. Runway Identification	<u> </u>
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
16. Airline gates	
17. General aviation basing areas	
C. ATC Procedures	
18. Aircraft separation 19. Route data	
20. Two-way path data 21. Common approach paths	
22. Vectoring delays	
23. Departing runway queue control 24. Gate hold control	
25. Departure airspace constraints 26. Departure queue	
27. Runway crossing delay control	
D. Aircraft Operational Characteristics	
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy time	
31. Departure runway occupancy times	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35 Airenace travel time	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	1987 Demand

# EXPERIMENT NO. 26

#### Objective:

To assess delays to aircraft in 1987 for the following runway configuration in IFR 1 with an improved 1987 ATC system scenario and 1982 improvements plus the satellite terminal and/or remote parking for 20 aircraft.

#### ARRIVAL RUNWAYS

**DEPARTURE RUNWAYS** 

24R, 24L, 25R, 25L

24L, 25R

# Related Comparison Experiments:

Prior Experiment #12 is identical except for the improvements from 1982 to 1987 and the demand.

#### Remaining Data Items:

Demand distributions

SIMULATION MODEL INPUT DESCRIPTION OF INPUT CHANGE Logistics Title Random number seeds 3. Start and finish times Print options Airline names Processing options Truncation limits 8. Time switch AirTield Physical Characteristics Configuration "A" Airfield network 10 Number of runways Kunway Identification 12. Departure runway and links 13. Runway crossing links 14. Exit taxiway location 15. Holding areas 16. Airline gates 17 General aviation basing areas ATC Procedures 18. Aircraft separation 19. Route data Two-way path data Common approach paths 22. Vectoring delays Departing runway queue control 24. Gate hold control Departure airspace constraints Departure queue Runway crossing delay control Aircraft Operational Characteristics Exit taxiway utilization 29. Arrival runway occupancy times Touch-and-do runway occupancy time 31. Departure runway occupancy times Taxi speeds Approach speeds Gate service times 34. 35 Airenaco traval times Runway crossing times 37. Lateness distributions 38. Demand 1987 Demand

#### EXPERIMENT NO. 22

#### Objective:

To assess the delay impact to aircraft in 1978 for the following runway configuration in VFR 1 due to the runway closure of 25R during work on the Spulveda Tunnel.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 24L, 25L

24R, 24L, 25L

#### Related Comparison Experiments:

Prior Experiment #1 is identical except for closure of 25R for tunnel construction.

	CIMIL ATTON MODEL TABLET	
	SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A.	Logistics	
	l. Title	
	2. Random number seeds	
	3. Start and finish times	
	4. Print ontions	
	5. Airline names	
<u> </u>	6. Processing options	
<b> </b>	7. runcation limits	
8.	8. Time switch Alphaeld Physical Characteristics	
-		Configuration "A"
<del> </del> -	9. Airfield network  0. Number of runways	
	T. Kunway identification	
	2. Departure runway and links	
	3. Runway crossing links	
-	4. Exit taxiway location	
	5. Holding areas	
1	6. Airline gates	
1	7. General aviation basing areas	
C. A	TC Procedures	
	8. Aircraft separation	
1	9. Route data	
	O. Two-way path data	
	1. Common approach paths	
_	2. Vectoring delays	
	3. Departing runway queue control 4. Gate hold control	
_	5. Departure airspace constraints	
	6. Departure queue	
	7. Runway crossing delay control	
	ircraft Operational Characteristics	
_	8. Exit taxiwav_utilization_	
	9. Arrival runway occupancy times	
	U. Touch-and-do runway occupancy time	
	1. Departure runway occupancy times	
	2. Taxi speeds	
_	3. Approach speeds	
	4 Gate service times	
	6. Runway crossing times	
	6. Runway crossing times 7. Lateness distributions	
		Reassign arrivals and departures from
		25R to 25L

# EXPERIMENT NO. 22A

# Objective:

To assess the delay impact to aircraft in 1982 for the following runway configuration in VFR 1 due to the runway closure of 25R during work on the Sepulveda Tunnel with a dual taxiway system around satellite 4.

#### ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24L, 24R, 25L

24L, 24R, 25L

# Related Comparison Experiments:

Prior Experiment #22 is identical except for a dual taxiway system and a 1982 demand.

ST	MILL ATTOM MODEL TARRIT	
	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
1.		
2.	Random number seeds	
3.	Start and finish times	
4.	Print options	
5.	THE HAMES	
6.	Processing options	
7.	Truncation limits	<u> </u>
8. 8. Ai	Time switch	<u> </u>
D. AII	rfield Physical Characteristics	Configuration "A"
9.	Airfield network	
10	Number of runways	
}	Runway identification	
12.	Departure runway and links	
<u> </u>	Runway crossing links	
14.	Exit taxiway location	
	Holding areas	
16.	Airline gates	
17.	General aviation basing areas Procedures	
18.	Aircraft separation Route data	
20.		New route structure
21.	Two-way path data Common approach paths	
22.	Vectoring delays	
23.		
24.	Departing runway queue control Gate hold control	
25.	Departure airspace constraints	
26.	Departure queue	
27.		
D. Airc	raft Operational Characteristics	
28.	Exit taxiway utilization	
29.	Arrival runway occupancy times	
30.	Touch-and-go runway occupancy time	\$
31.	Departure runway occupancy times	
32.	Taxi_speeds	
33.	Approach speeds	
34.	Gate service times	
35	Airspace travel times	
36. 37.	Runway crossing times Lateness distributions	
38.		Reassign arrivals and departures from
30	Demand	25R to 25L (1982 Demand)
		ZOR (U ZOL (1202 Demand)

#### EXPERIMENT NO. 23

#### Objective:

To assess the delay impact to aircraft in 1978 for the following runway configuration in IFR 1 due to the runway closure of 25R during work on the Sepulveda Tunnel.

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 25L

24L, 25L

#### Related Comparison Experiments:

Prior experiment #2 is identical except for the closure of runway 25R.

	MULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Lo	gistics	
1.		
2.	Random number seeds	
3.	Start and finish times	
4.	Print options	
5.	Airline names	
6.		
7.	Truncation limits	
8.		
B. A1	rfield Physical Characteristics	Configuration "A"
9.	Airfield network	
10	Number of runways	
11.	Runway identification	
12.	Departure runway and links	
13.	Runway crossing links	
14.	Exit taxiway location	
15.	Holding areas	
16.		
<u>17.</u>	General aviation basing areas	
	Procedures	
18. 19.	Aircraft separation Route data	 
		New departure routes to 25R for Class
20. 21.	Two-way path data Common approach paths	
22.	Vectoring delays	
23.		
24.	Departing runway queue control Gate hold control	
25.	Departure airspace constraints	
26.	Departure queue	
27.	Runway crossing delay control	
D. Airc	raft Operational Characteristics	
28.	Exit taxiway utilization	
29.	Arrival runway occupancy times	
30.	Touch-and-go runway occupancy time	
31.	Departure runway occupancy times	
32.	Taxi speeds	
33.	Approach speeds	
34.	Gate service times	
35	Airspace travel times	
36. 37.	Runway crossing times	
	Lateness distributions	
38	Demand	Reassign arrival and departures from 25R to 25L
		BON TO BOLL

# EXPERIMENT NO. 24

# Objective:

To assess the delay impact to aircraft in 1978 for the following runway configuration in IFR 1 due to the runway closure of 25L during work on the Sepulveda Tunnel (in 79).

# ARRIVAL RUNWAYS

DEPARTURE RUNWAYS

24R, 25R

24L, 25R

#### Related Comparison Experiments:

Prior Experiment #2 is identical except for the closure of runway 25L for tunnel construction.

SIMULATION MODEL INPUT	DESCRIPTION OF INPUT CHANGE
A. Logistics	
l. Title	
2. Random number seeds	
<ol><li>Start and finish times</li></ol>	
4. Print options	
5. Airline names	
6. Processing options	·
7. Truncation limits	
8. Time switch	
5. Airfield Physical Characteristics	Configuration "A"
9. Airfield network	
10 Number of runways	
11. Runway Identification	
12. Departure runway and links	
13. Runway crossing links	
14. Exit taxiway location	
15. Holding areas	
16. Airline gates	
17. General aviation basing areas	
C. ATC Procedures	
18. Aircraft separation	
19. Route data	
20. Two-way path data 21. Common approach paths	
approbation parameter	
22. Vectoring delays	
23. Departing runway quaue control 24. Gate hold control	
25. Departure airspace constraints 26. Departure queue	
27. Runway crossing delay control D. Aircraft Operational Characteristic	•
28. Exit taxiway utilization	
29. Arrival runway occupancy times	
30. Touch-and-go runway occupancy	
31. Departure runway occupancy tim	
32. Taxi speeds	
33. Approach speeds	
34. Gate service times	
35. Airspace travel times	
36. Runway crossing times	
37. Lateness distributions	
38. Demand	Reassign arrival and departures from
. · · · · · · · · · · · · · · · · · · ·	25L to 25R